

**CHAPTER 9 A View of Earth's Past**

**SECTION 1 Geologic Time**

**KEY IDEAS**

As you read this section, keep these questions in mind:

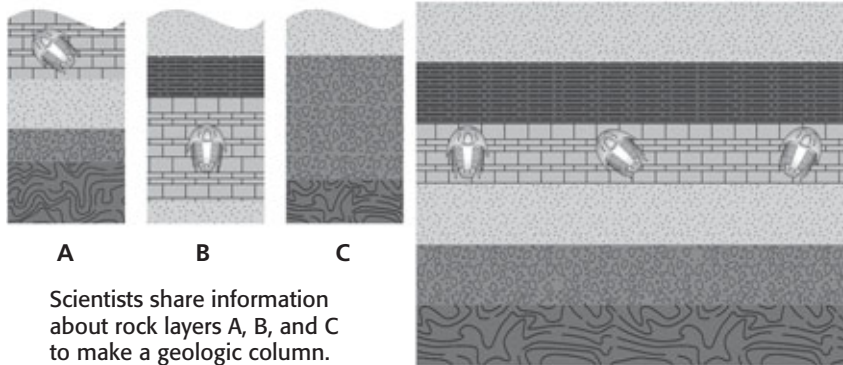
- How did scientists work together to develop the geologic column?
- What are the major divisions of geologic time?

**What Is a Geologic Column?**

Earth's surface is always changing. The layers of rock in Earth's crust record these changes. Scientists study these rock layers to learn about Earth's history.

No one area on Earth has a complete record of Earth's history. Therefore, scientists from around the world share what they learn from the rock record. These scientists developed a standard order of rock layers called a **geologic column**. The oldest rocks are at the bottom of the column. The more recent rocks are at the top of the column. ✓

In a geologic column, different layers hold different types of rock and fossils. Fossils in the upper layers look like modern plants and animals. Many fossils in the lower, older layers are from extinct plants and animals.



Scientists share information about rock layers A, B, and C to make a geologic column.

Geologic column

**USING A GEOLOGIC COLUMN**

Scientists can use geologic columns to estimate the ages of rock layers. Scientists compare a layer of rock with a similar layer in a geologic column. The layers they compare may be in the same position relative to other layers. They may have the same fossils. If the two rock layers match, they probably formed around the same time.

**READING TOOLBOX**

**Summarize in Pairs** Read this section quietly to yourself. Then, talk with a partner about what you read. Work together to figure out the parts that you did not understand.

**READING CHECK**

**1. Explain** Why did scientists have to work together to develop the geologic column?

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**LOOKING CLOSER**

**2. Identify** Circle the oldest layer of rock in the geologic column.

**SECTION 1 Geologic Time** *continued*

**Talk About It**

**Make Comparisons** Just like human society, Earth has a history. With a partner, discuss how a geologic time scale is similar to a timeline found in history books.

**What Are the Divisions of Geologic Time?**

Scientists use what they have learned from rocks and fossils to create a geologic time scale. The geologic time scale identifies major events in Earth’s past. It also summarizes changes in Earth’s surface, climate, and organisms over time. Scientists use these changes to divide the geologic time scale into smaller units. Fossils from certain organisms characterize each unit of geologic time, as shown on the next page.

**EONS**

The largest unit of geologic time is an *eon*. Geologic time has four eons, as shown below. The first three eons are part of *Precambrian time*. Precambrian time lasted 4 billion years. It makes up most of Earth’s history. After Precambrian time, the Phanerozoic Eon began.

- |                  |   |   |
|------------------|---|---|
| Precambrian time | { | <ul style="list-style-type: none"> <li>• Hadean Eon</li> <li>• Archean Eon</li> <li>• Proterozoic Eon</li> <li>• Phanerozoic Eon</li> </ul> |
|------------------|---|---|

**ERAS**

Eons are divided into shorter units of time called **eras**. The Phanerozoic Eon has three eras.

**Eras in the Phanerozoic Eon**

Era	Length	Common Fossil Types
Paleozoic	291 million years	variety of sea and land organisms
Mesozoic	186 million years	early birds and reptiles
Cenozoic	65 million years (continuing)	mammals

**LOOKING CLOSER**

**4. Identify** Which era are we living in right now?

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**PERIODS, EPOCHS, AND AGES**

Eras are divided into shorter units of time called **periods**. Each period has specific types of fossils. Periods are usually named for the place where the fossils were first found. For example, the *Jurassic Period* is named for the Jura Mountains in Europe.

Sometimes periods are divided into shorter units called **epochs**. Scientists make this division only if there is enough information from the fossil record. Epochs can be divided into even shorter units called *ages*. Scientists need a detailed fossil record to mark ages.

**SECTION 1** **Geologic Time** *continued*

<b>Era</b>	<b>Period</b>	<b>Epoch</b>	<b>Beginning of Interval (millions of years ago)</b>	<b>Characteristics from Fossils and Geologic Evidence</b>
Cenozoic	Quaternary	Holocene	0.0115	The last glacial period ends; complex human societies develop.
		Pleistocene	1.8	Woolly mammoths, rhinos, and humans appear.
	Tertiary	Pliocene	5.3	Large carnivores, such as bears and lions, appear.
		Miocene	23.0	Grazing herds are abundant; raccoons and wolves appear.
		Oligocene	33.9	Deer, pigs, camels, cats, and dogs appear.
		Eocene	55.8	Horses, flying squirrels, bats, and whales appear.
		Paleocene	65.5	The age of mammals begins; the first primates appear.
Mesozoic	Cretaceous		146	Flowering plants and modern birds appear. Mass extinctions mark the end of the Mesozoic Era.
	Jurassic		200	Dinosaurs are the dominant animals; primitive birds and flying reptiles appear.
	Triassic		251	Dinosaurs and mammals appear; ammonites are common in the oceans; cycads and conifers are common plants.
Paleozoic	Permian		299	Pangaea comes together. Mass extinctions mark the end of the Permian Era.
	Carboniferous	Pennsylvanian Period	318	Giant insects are common; reptiles appear. Huge coal deposits begin to form.
		Mississippian Period	359	Amphibians are common on land; brachiopods are common in the oceans. Forests and swamps cover most of the land.
	Devonian		416	The age of fishes begins; amphibians appear; giant ferns and seed-bearing plants appear.
	Silurian		444	Eurypterids and land plants and animals appear.
	Ordovician		488	Echinoderms appear; brachiopods become more common; trilobites begin to decline.
	Cambrian		542	Trilobites and other shelled marine organisms are common. The atmosphere becomes rich in oxygen.
	Precambrian time			4,600

# Section 1 Review

## SECTION VOCABULARY

**epoch** a subdivision of geologic time that is longer than an age but shorter than a period

**era** a unit of geologic time that includes two or more periods

**geologic column** an ordered arrangement of rock layers that is based on the relative ages of the rocks and in which the oldest rocks are at the bottom

**period** a unit of geologic time that is longer than an epoch but shorter than an era

**1. Organize** List the following units of time from shortest to longest: *age, eon, epoch, era, period, year*.

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**2. Infer** Where on a geologic column would you most likely find fossils of extinct organisms? Explain your answer.

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**3. Explain** How can scientists use a geologic column to determine a rock layer's age?

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**4. Describe** Choose one period from the geologic time scale and describe its major events.

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**5. Infer** The Tertiary Period is divided into five epochs. What can you infer about the fossil record of this period?

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**6. Predict Consequences** Suppose a scientist found a mammal fossil from the Paleozoic Era. How would this change our understanding of Earth's history?

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